

**IHS National Epidemiology Program's
Most Recent Chronic and Infectious Disease
Abstracts
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Retrospective Review of Methicillin-resistant *Staphylococcus aureus* Using Laboratory Surveillance of Indian Health Service (IHS) Facilities.

DH Wolsey, J Cheek, and B Umland

Objective: To assess the rates of Methicillin-resistant *Staphylococcus aureus* (MRSA) infections among Indian Health Service (IHS) facilities, to identify areas at high risk for MRSA, and to examine any geographic differences.

Background: Community-acquired MRSA infections have been reported in several populations including reports among the Australian Aboriginal populations. Little is known regarding infections among other indigenous groups, and currently no information is available regarding the frequency, transmission or risk factors related to community-acquired MRSA infection among American Indian (AI) populations. An increase in lab confirmed MRSA was noticed among several IHS facilities. Many of these appeared to be community-acquired rather than the more common nosocomially acquired infections.

Methods: IHS facilities with laboratories performing antimicrobial susceptibility testing were surveyed. Information on *S. aureus* infections was requested for a one year period including age, gender, date of culture, culture site and method, and antibiotic susceptibility pattern. Comparisons were made between the following geographic locations: Northern Plains (NP), Southwest (SW), and Northwest (NW).

Results: Forty-one of 56 (73.2%) facilities responded. MRSA prevalence rates ranged from 0-17.6/1,000 per year. NP facilities had rates nine times higher than the SW and 37 times higher than the NW. MRSA positivity rates (percent of SA isolates resistant to methicillin) were also significantly higher in the NP.

Antimicrobial resistance patterns differed between the areas with the SW having significantly higher resistance to multiple antibiotics compared to the NP.

Conclusions: IHS facilities, especially in the NP, have high rates of MRSA infections which have resistance patterns suggesting community-acquired infections. Clinicians need to be aware of resistant patterns at their facilities in order to provide appropriate empiric therapy. Additionally, patients need to be educated regarding the risk of over using antibiotics.

Modeling Relationships Between Climate and the Frequency of Human Plague Cases in the Southwestern United States, 1960-1997.

Russell Ensore, Brad Biggerstaff, Ted Brown, Ralph Fulgham, Pamela Reynolds, David Engelthaler, Craig Levy, Robert Parmenter, John Monteneri, James Cheek, Richie Grinnell, Paul Ettestad, and Gregory Glass.

Abstract: The relationships between climatic variables and the frequency of human plague cases (1960-1997) were modeled by Poisson regression for two adjoining regions in northeastern Arizona and northwestern New Mexico. Model outputs for both regions (expected number of cases) closely agreed with the numbers of cases actually observed, suggesting that temporal variations in plague risk can be estimated by monitoring key

climatic variables, most notably summer threshold temperature values and time-lagged amounts of late winter (February-March) precipitation. Significant effects also were observed for time-lagged monsoon precipitation (July-August) in the Arizona model. Increased precipitation during specific periods resulted in increased numbers of expected cases. The number of days above certain high threshold temperatures exerted a strongly negative influence on the numbers of expected cases in both the Arizona and New Mexico models (35 degrees Celsius and 32.2 degrees Celsius, respectively). At lower threshold values, positive temperature effects were identified in both models (32.2 degrees Celsius and 29.4 degrees Celsius, respectively). The climatic variables found to be important in our models are those that would be expected to influence strongly the population dynamics of the rodent hosts and flea vectors of plague.

Submitted for publication.

Using Remotely Sensed Data To Identify Areas at Risk For Hantavirus Pulmonary Syndrome

Gregory Glass, James Cheek, Jonathan Patz, Timothy Shields, Timothy Doyle, Douglas Thoroughman, Darcy Hunt, Russell Enscoe, Kenneth Gage, Charles Irland, C.J. Peters, and Ralph Bryan.

Abstract: The 1993 U.S. hantavirus pulmonary syndrome (HPS) outbreak was attributed to environmental conditions and increased rodent populations caused by unusually weather in 1991-92. In a case-control study to test this hypothesis, we estimated precipitation at 28 HPS and 170 control sites during the springs of 1992 and 1993 and compared it with precipitation during the previous 6 years by using rainfall patterns at 196 weather stations. We also used elevation data and Landsat Thematic Mapper satellite imagery collected the year before the outbreak to estimate HPS risk by logistic regression analysis. Rainfall at case sites was not higher during 1992-93 than in previous years. However, elevation, as well as satellite data, showed association between environmental conditions and HPS risk the following year. Repeated analysis using satellite imagery from 1995 showed substantial decrease in medium - to high - risk areas. Only one case of HPS was identified in 1996.

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Emerging Infectious Diseases in American Indians and Alaska Natives

Jim Cheek

Although American Indians and Alaska Natives (AI/AN) account for approximately one percent of the U.S. population, they are affected disproportionately by several emerging infections. In the case of zoonotic diseases, such as Hantavirus Pulmonary Syndrome, Plague, and Rocky Mountain Spotted Fever, AI/ANs experience annual incidence or hospitalization rates 20 to 40 times the overall U.S. rates. The simplest explanation for this

apparent increased risk may lie in the overlap in environments of many rural AI/AN and the small mammals carrying disease. Another type of infectious disease recently appearing in AI/AN populations is methicillin-resistant *Staphylococcus aureus* (MRSA) acquired outside the nosocomial setting. Some rural clinics serving AI populations report recently that over 60 percent of *Staphylococcus aureus* isolates are MRSA. In one study of a rural AI community, 74% of 62 MRSA infections could not be linked to any of the typical nosocomial risk factors for MRSA including exposure within the previous year to hospitals, long term care facilities, renal dialysis, or injecting drug use. Characteristics of patients with MRSA were indistinguishable from those of patients with methicillin-sensitive *Staphylococcus aureus*. A final example of an infectious disease disproportionately affecting AI/AN is tuberculosis. The annual incidence rate for TB among AI/AN, although declining, remains twice that of the U.S. overall rate. TB mortality rates persist at a staggering six times the U.S. overall rate. Possible reasons for the persistence of TB in this population may lie in a combination of the historical high incidence of infection and the increasing incidence of Type 2 Diabetes. The result of these two factors is a population with high rates of latent TB infection that is reactivating at a much higher rate than normal as a result of Diabetes. Because AI/AN experience these and other infectious diseases at higher rates than non-AI/AN, they could be considered sentinel populations for the early identification of emerging infections.

Presented at the 2nd International Conference on Emerging Infectious Diseases, Atlanta, GA, July 16-19, 2000.

Meningococcal Outbreak Amplified by a Community Gathering

Rebecca K. Olson, PhD, James E. Cheek, MD, MPH, Ronald E. Voorhees, MD, MPH, Paul Ettestad, DVM, MS, Linda Nims, MS, C. Mack Sewell, DrPH, MS.

Objective: To investigate the first reported outbreak of serogroup C meningococcal disease in New Mexico and identify risk factors for infection.

Design: Outbreak investigation with a household case-control study.

Setting: Five adjoining rural communities in Northwestern New Mexico during March 1995.

Subjects: Cases were defined by isolation of serogroup C *Neisseria meningitidis* from a normally sterile body site; probable cases had a clinical diagnosis. Each case-patient household was matched with three or four neighboring control households.

Interventions: Outbreak investigation and control included surveillance for new cases, investigation and prophylaxis of contacts of cases, vaccination clinics, a carriage study, and a household case-control study.

Main outcome measure: Matched odds ratios.

Results: Seven confirmed cases of ET-17 serogroup C meningococcal disease and three probable cases occurred in the five communities between March 2-16, 1995; two deaths occurred. The 10 case-patients ranged in age from 3 to 56 years. Six case-patients were male; nine were American Indian and one was Hispanic. Seven case-patients were linked

to a community gathering on March 4. The household case-control study revealed that members of case-patient households were significantly more likely to have attended this gathering than members of neighborhood control households [matched odds ratio = ; 95% confidence interval = (2.31,)]. Carriage of *N. meningitidis* was found in 5 (5.6%) of 89 schoolmates or staff and one (5.9%) of 17 family members of the final case-patient, but none matched the outbreak strain.

Conclusions: A small gathering greatly amplified this community outbreak of meningococcal disease.

Epidemiology of hospitalizations associated with otitis media among children less than 5 years of age, United States and Indian Health Service, 1988-1996.

Aaron T. Curns, MPH, Robert C. Holman, MS, David K. Shay, MD, MPH, James E. Cheek, MD, MPH, Stephen F. Kaufman, MS, and Larry J. Anderson, MD

Objective: Examine otitis media (OM) associated hospitalizations among the general U.S. population and American Indian/Alaska Native (AI/AN) children less than 5 years of age.

Methods: Hospitalizations with a discharge diagnosis of OM were selected from the National Hospital Discharge Survey and the Indian Health Service inpatient hospitalization database for the years 1988 through 1996. Cost estimates of OM-associated hospitalizations were calculated using the Healthcare Cost and Utilization Project Nationwide Inpatient Sample for 1997.

Results: Among U.S. children, the OM-associated hospitalization rate for 1994-96 was 1021 per 100,000. The rate for AI/AN children was 1542 per 100,000. OM-associated hospitalization rates decreased 22% for U.S. children and 40% for AI/AN children. For U.S. children, the most commonly listed procedures were lumbar puncture for children less than 1 year of age (infants) and myringotomy with tube insertion for children 1 to 4 years of age. For AI/AN children, administration of medication with a nebulizer was the most commonly listed procedure for both infants and children 1 to 4 years of age. In 1997, the total U.S. cost of OM-associated hospitalizations with operations on the middle and inner ear was over \$60 million.

Conclusions: AI/AN children had higher rates of OM-associated hospitalizations than those for U.S. children. Black children had double the OM-associated hospitalization rate of white children and was at a level comparable to AI/AN children. OM hospitalization rates decreased over time although the AI/AN rate decreased more rapidly than the U.S. rate. OM-associated hospitalizations are not rare and the costs associated with these hospitalizations are substantial. As vaccines that may reduce OM-related morbidity are introduced, OM-associated hospitalization estimates can be used to gauge the impact of these vaccines.

Submitted for publication, Jan. 2001

Evaluation of Tuberculosis Prevention Among American Indian Patients with Diabetes

Jennifer Giroux, MD, Betty Skipper, PhD, Thomas Welty, MD, MPH, Kelly Acton, MD, MPH, and James Cheek, MD, MPH

Background: American Indian (AI) patients with type 2 diabetes have a three to five fold greater risk for progression to active tuberculosis (TB) than patients without diabetes. Indian Health Service (IHS) guidelines recommend that all patients with diabetes be administered PPD tuberculin skin tests. If positive and not previously prophylaxed, patients should receive isoniazid (INH) therapy to prevent progression to TB disease. To monitor clinical care of patients with diabetes, the IHS Diabetes Program annually audits a national sample of patient records.

Methods: We evaluated screening and treatment of TB among AI patients with diabetes for 1995-98 using data from this audit. Patients were assigned to one of the following four categories: PPD positive / treated, PPD negative, PPD status unknown (inadequate screening), and PPD positive / untreated (inadequate treatment). We evaluated trends over time and regional differences by IHS service areas.

Results: Nationally, the proportion of inadequately screened patients showed no decline over the 4-year period (range: 36%-38%), nor did the proportion of variation in the inadequately screened group ranged from 12% to 76%, and in the inadequately treated group range from 6% to 31%.

Conclusion: Active TB could be prevented in some AI patients by improved screening and prophylaxis in patients with diabetes. Because diabetes incidence continues to increase in AI populations, TB morbidity and mortality may also increase unless screening and prophylaxis improve.

Presentation at the American Public Health Association Annual Meeting, Paper #7942: November 2000.

Trends in Hospitalizations Associated with Invasive Pneumococcal Disease in the Indian Health Service User Population.

Christina Hammond, RN, Bob Holman, MS, James Cheek, MD, MPH

Very high rates of invasive pneumococcal disease have previously been reported for American Indian and Alaska Native communities in the Southwestern United States and Alaska. This study used hospital discharge records maintained by the Indian Health Service to examine hospitalization rates associated with this disease in the Southwest, Alaska, and three other regions of the United States. Age-specific, temporal, fatality, and geographic trends from 1980 through 1996 were described. The findings indicate that overall hospitalization rates for this disease decreased over time, particularly in the age group at highest risk (infants). However, infants remain the highest-risk age group. There was also a small but significant increase in hospitalization rates for middle-aged adults and a significant increase in overall hospital fatality rates for this disease during the study period. A large percentage of the hospitalizations and the majority of fatalities occurred in

persons for whom the polysaccharide vaccine was clearly indicated based on age or chronic medical conditions. Based on this study's findings, full implementation of the current conjugate vaccine recommendations could potentially prevent over two-thirds of hospitalizations for invasive pneumococcal disease in this population.

Manuscript in preparation.

Trends in Infectious Disease Hospitalizations among American Indians and Alaska Natives

Robert C. Holman, MS, Aaron T. Curns, MPH, Stephen K Kaufman, MS, James E. Cheek, MD, MPH, Robert W. Pinner, MD, and Lawrence B. Schonberger, MD

Objective: To describe trends in hospitalizations associated with infectious diseases among American Indians and Alaska Natives (AI/ANs).

Methods: Infectious disease hospitalizations and rates among AI/ANs from 1980 through 1994 were examined by using Indian Health Service (IHS) hospital discharge data and compared with published trends for the general U.S. population.

Results: Annual hospitalization rates for infectious disease among AI/ANs decrease 31.0% during 1980 through 1994. Infectious disease hospitalizations accounted for 16.3% of all hospitalizations in 1980 and 21.2% in 1994, an increase of 30.1%. In 1994, the infectious disease hospitalization rate was 1613 per 100,000 (age-adjusted rate of 1863 per 100,000 population), and the highest rate was among infants (15631 per 100,000). Hospitalizations rates increased for HIV/AIDS, infection and inflammatory reaction to prosthetic devices, postoperative infection, oral infections, septicemia, and osteomyelitis. Rates decrease for meningitis, tuberculosis, infections of the heart, and enteric infections groups.

Conclusions: Hospitalization trends for infectious diseases show that there has been improvement in the health of AI/ANs, but also indicate that AI/ANs have a higher infectious disease burden than the general U.S. population.

In press, American Journal of Public Health

Promoting Safer Water Hauling Practices in the Navajo Nation: A Pilot Intervention Study

J. DeGroat, A.V. Groom, M. Jasperse, T. Galvan, D.K. Wolsey, E. Tsosie, J. Cheek, and R. Bryan

Issue: On the Navajo Nation, some 25% of the population hauls water for home use and previous disease outbreaks have been linked to water-hauling practices. We sought to characterize current water hauling/storage practices, assess knowledge of waterborne diseases, and assess the acceptability of intervention water containers.

Program: After a random baseline survey, each household received a 55-gallon outdoor water container and a 2.5 or 5-gallon indoor container. All containers had covers, narrow-

mouthed openings and spigots. A follow-up survey assessed the use and acceptability of these containers.

Outcomes: Of 44 households surveyed, the mean number of water-hauling containers used was 4.54/household. Participants made a median of 8 water-hauling trips/month, hauling a median of 110 gallons/trip. Methods for water storage/removal included using siphon hoses to remove water from hauling containers (22 (50%)); storing water inside homes in open buckets (24 (55%)); and using dipping devices to remove water from storage containers (25 (57%)). Notably, 23 (52%) participants reported reducing personal hygiene measures or household chores due to limited water; 34 (77%) reported sometimes or never boiling drinking water; and 26 (59%) reported never using chlorine or other water disinfectants. Although 40 (90%) respondents believed that germs in water could cause illness, only 14 (32%) stated that improper storage contributed to contamination, and only 13 (30%) said that contact with dirty hands could contaminate water. Most participants said they would continue to use both the outdoor (93%) and indoor (95%) intervention containers, but 28 (67%) participants had continued to use other containers in addition to the ones provided.

Lessons Learned: The potential for water contamination during storage/dispensing is high among those surveyed. Although most respondents were aware of the role of contaminated water in disease transmission, few reported water use practices that would reduce the risk of waterborne disease in their homes. Despite high satisfaction with the intervention containers, these containers likely did not reduce the potential for water contamination as intervention containers often supplemented, rather than replaced, existing containers. These findings suggest that this population would utilize intervention water containers, but that supplemental health education efforts should stress proper water storage, removal, and disinfection techniques.

Poster Presentation at the International Conference on Emerging Infectious Diseases, July 2000

Hantavirus: An Emerging Infection?

Amy Groom and James Cheek

Chapter in **Emerging Infectious Diseases: Trends and Issues**, *In press*

This chapter will review hantaviruses, with a focus on those found in North America. Old world hantaviruses will be described primarily as comparisons with New World agents. Results of recent studies of Sin Nombre Virus (SNV) and areas of active research will be examined.

Emergence of Community-Acquired Methicillin-Resistant *Staphylococcus aureus* in a Rural American Indian Community.

A. Groom, T. Naimi, D. Wolsey, K. Smith, S. Johnson, K. Moore, J. Cheek

Background: Methicillin-resistant *Staphylococcus aureus* (MRSA) infection is usually nosocomially-acquired. An increasing number of MRSA infections in patients lacking

nosocomial risk factors, however, have been reported from several rural American Indian (AI) communities. We evaluated prevalence and risk factors for MRSA infection in one such community.

Methods: Lab-confirmed *S. aureus* infections in outpatients (N=112) seen at one facility between January 1 and December 31, 1997 were evaluated using a retrospective case-control design and medical chart review. A case-patient was defined as having a *S. aureus* isolate resistant to methicillin using Kirby-Bauer disk diffusion and oxacillin screen plate; controls were all patients with *S. aureus* isolates sensitive to methicillin (MSSA). Polymerase chain reaction testing for the *mecA* gene and pulsed-field gel electrophoresis (PFGE) were performed on 10 (16%) and 50 (81%) of MRSA isolates, respectively.

Results: Sixty-two (55%) of *S. aureus* isolates were MRSA, and all tested MRSA isolates revealed the presence of the *mecA* gene. Most infections involved skin or soft tissues (54 [87%]). Only 16 (26%) MRSA cases had typical risk factors (e.g. hospitalization within the last 12 months, residence in a long-term care facility, IV drug use or hemodialysis). Most MRSA isolates were susceptible to multiple antibiotics. There were no significant differences between MRSA case-patients and MSSA controls with regard to risk factors, including prior antibiotic use. By PFGE subtyping, 76% of tested MRSA isolates were one of three closely related patterns.

Conclusion: A large proportion of *S. aureus* infections in this community are MRSA, most of which appear to be community-, not nosocomially-, acquired. MRSA isolates are clonally related and exhibit susceptibility to multiple antibiotics. Individual antibiotic use does not appear to be a risk factor associated with MRSA infection in this rural community.

Poster Presentation at the Interscience Conference on Antimicrobials and Chemotherapies (ICAAC), September 1999

Rocky Mountain Spotted Fever in Oklahoma American Indians

Jennifer H. McQuiston, DVM, MS; Robert C. Holman, MS; Amy V. Groom, MPH; Stephen F. Kaufman, MS; James E. Cheek, MD, MPH; James E. Childs, ScD.

Objective. Although Oklahoma accounts for over 11% of reported Rocky Mountain spotted fever (RMSF) cases in the United States, the incidence of RMSF among the Oklahoma American Indian population has not been evaluated. Because a rural lifestyle may place persons at increased risk for tick bites, the authors sought to determine whether American Indians in Oklahoma had an increased incidence of RMSF.

Methods. The authors retrospectively reviewed an Indian Health Service (IHS) hospital discharge database to examine RMSF hospitalizations from 1980 through 1996 and reviewed available medical charts from four IHS hospitals. In addition, the authors reviewed RMSF case report forms submitted to the Centers for Disease Control and Prevention (CDC) from 1981 through 1996.

Results. According to the IHS database, Oklahoma American Indians were hospitalized with RMSF at an annual rate of 48.2 per million population, compared with 16.9 for Oklahoma residents. However, only 31% of cases the authors reviewed met the national definition for laboratory-confirmed RMSF. The incidence of RMSF for Oklahoma American Indians reported to CDC by case report forms was 37.4 cases per million, compared with 21.6 for all Oklahoma residents (RR 1.7, 95% CI 1.5-2.1).

Conclusions. Although rates derived from the IHS database could not be reliably compared with national rates, analysis of case report forms indicated that Oklahoma American Indians have a significantly higher incidence of RMSF than the overall Oklahoma population. Oklahoma American Indians may benefit from educational campaigns emphasizing prevention of tick bites and exposure to tick habitats.

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Epidemiology and Clonality of Community-Acquired Methicillin-Resistant *Staphylococcus aureus*: Minnesota and the North Central United States, 1996-1998

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Background Methicillin-resistant *Staphylococcus aureus* (MRSA) has recently emerged as a community-based pathogen in patients without established MRSA risk factors; we sought to describe the epidemiology and microbiology of community-acquired (CA) MRSA infections in Minnesota.

Methods Records from 10 Minnesota hospital laboratories were reviewed to identify patients with MRSA infections from 1996-1998; medical records were reviewed to identify CA-MRSA cases (those without established nosocomial risk factors in the year prior to infection). Antimicrobial susceptibility testing and pulsed-field gel electrophoresis (PFGE) subtyping were performed on available isolates from Minnesota and other north central states.

Results 354 CA-MRSA cases were identified in Minnesota. Cases were young (median age, 16 years) and generally healthy. Most cases (313) lived in low-income areas; most (266) were racial minorities. Most cases (299, 84%) had skin infections; 103 (29%) were hospitalized. Greater than 90% of isolates were susceptible to all antimicrobial agents tested except beta-lactams and erythromycin. However, of 334 patients treated with antimicrobials agents, 282 (84%) were initially treated with agents to which their MRSA isolate was non susceptible. Of 174 Minnesota isolates tested by PFGE, 150 (86%) belonged to one clonal group. Fifty-seven of 66 (86%) CA-MRSA isolates tested from other states also belonged to this clonal group.

Conclusions CA-MRSA infections were identified throughout Minnesota; those living in low- income areas were disproportionately represented. PFGE subtyping suggests transmission of related CA-MRSA organisms in Minnesota and the North Central United States. Although CA-MRSA isolates were susceptible to multiple antimicrobials, they were generally non susceptible to empiric antimicrobial therapy.

Abstract submitted for publication

Control of a Hepatitis A Outbreak by Mass Vaccination of School-age Children in an American Indian Population Using Hepatitis A Vaccine

Douglas A. Thoroughman, James E. Cheek, Theresa D. Cullen, Susan A. Matt, Darcy H. Wolsey

Abstract

The purpose of this study was to evaluate the effectiveness of vaccinating school-age children to stop an outbreak of hepatitis A in a population with high endemicity of hepatitis A. Suspected hepatitis A cases were serologically confirmed. Vaccination occurred in school settings only. Of an estimated 2,891 children aged 2 -- 16 years living on the reservation and with no history of hepatitis A, 1,648 (57%) received the first dose of vaccine in April 1997. Approximately 28% (168/604) of preschool-age children and 65% (1480/2287) of school-age children were vaccinated. Incidence decreased from an average of five cases/week to no cases/week within 4 weeks of administration of the first dose. Despite low vaccine coverage of preschool-age children, the outbreak ended after mass vaccination of school children. Community-wide outbreak control may be possible in communities with high hepatitis A endemicity by targeting the most accessible children, those in school, for vaccination.

A Surveillance Evaluation of Hepatitis C in Plains Indian Reservations

Karin Garratt, Douglas Thoroughman, James Cheek, John Hauxwell

Abstract

An evaluation of hepatitis C (HCV) surveillance within Northern Plains Indians was performed to determine the adequacy of the current system. Three large tribes served by Indian Health Service (IHS) and one small tribe with a tribally-operated health care facility were evaluated. Charts of all people tested for HCV between May 1, 1997 and June 30, 1999 were reviewed. Reporting to State Departments of Health (DOH) was assessed by comparing all cases identified at each facility to those listed in state records. Supplemental HCV testing, risk factor recording, and indication of follow-up and/or treatment were also examined. Seventy-four (55%) of all preliminary cases identified were reported to state health departments. Sixty-four cases (44%), 11 of which were false positives, had supplemental testing. Supplemental testing had no association to reporting: only 27 (51%) of the remaining 135 preliminary cases who had supplemental testing were reported and 47 (57%) of those without supplemental testing were reported. Risk factor data was lacking in most charts and proved to be insufficient for meaningful use. It is imperative to standardize testing and reporting in order to generate accurate data on this emerging disease. Funding for prevention and/or early intervention programs is dependent on the accuracy of HCV surveillance.

Race Misclassification of American Indians in Oklahoma State STD Surveillance Data

Douglas A. Thoroughman, Debra Frederickson, Dan Cameron, James E. Cheek, Laura Shelby

Abstract

Sexually transmitted diseases (STDs) are in epidemic proportions in the United States today and the burden of these diseases is high in American Indian/Alaska Native (AI/AN) populations. Due to misclassification of race within STD surveillance data, the rate of occurrence of STDs such as chlamydia, gonorrhea, and syphilis may be much higher than reported for minorities like AI/ANs. In order to examine this possibility, Oklahoma State STD surveillance data for calendar year 1995 was matched to the Oklahoma State Indian Health Service Patient Registry to determine the number of AI/AN females who had one of these three STDs but were not listed on Oklahoma surveillance data as AI/AN. Accounting for racial misclassification increased the rate of chlamydia for AI/AN females in Oklahoma by 32% (342/100,000 vs. 452/100,000) in the overall population. For gonorrhea the rate increased by 57% (94/100,000 vs. 148/100,000) and for syphilis 27% (15/100,000 vs. 19/100,000). Misclassified AI/AN females were most likely to be classified as "white" and likelihood of misclassification increased with lower percentage of AI/AN ancestry. These findings indicate that rates of STDs may be underestimated for AI/AN populations nationwide and that racial misclassification on state surveillance data may be inaccurate in characterizing the burden of disease in minorities.

Using Web-based Performance Tracking and Training to Improve Screening and Treatment for STDs.

DE Peterson, L Shelby, J Bertolli, S Davis, J Cheek

Background: Surveillance for STDs is hampered both by providers' underutilization of screening tests and by mechanisms of reporting that often fail to capture many of the events of interest. Underutilization of screening tests can be due to inadequate knowledge of current screening recommendations and to overestimating the extent to which they are already screening. Treatment is likewise not always based on current recommendations. Performance feedback and training have been shown to improve the quality of care given by providers.

Objectives: Develop a web-based system to track provider and clinic performance on a number of STD-related measures, and to offer monthly performance feedback and training to participating clinics and providers.

Methods: We addressed issues in data extraction, filtering, and importation; translating site-specific laboratory and medication vocabularies; database and query design for efficient parsing large data sets; secure login, encryption and data security; using routine data for surveillance tables and provider indicators, and how to organize and provide web-based feedback and training.

Results: The web-based system is fully functional with secure login, defined views for providers and administrators, and query and training features. Fifteen clinical indicators for

tracking provider performance, and ten summary measures for following program performance, have been defined. Links to training for each clinical indicator are in place or being developed.

Conclusions: We have built a web-based system that provides training and feedback to providers and clinics to improve the quality of STD screening and care. Using algorithms on clinical data already present in Indian Health Services computerized medical databases (including laboratory, diagnoses, medications), it is able to detect most incident cases and yield reliable results for surveillance and control.

Learning Objective(s): Understand the various issues in, and the potential for, using web-based technologies to support improved surveillance and clinical care for STDs.

Overcoming barriers to Chlamydia surveillance in Indian Country: a lab-based Surveillance System

L Shelby, D Hunt

Background: The Indian Health Service (IHS) provides healthcare services for 1.2 million American Indians and Alaskan Natives (AI/ANs). Some studies indicate that AI/AN communities have high rates of chlamydia; however, comprehensive data is not available. Developing a national chlamydia surveillance system to monitor the disease burden in this population is challenging because IHS covers a large geographic area, reports chlamydia cases to many state health departments, and contracts with many laboratories for chlamydia testing.

Objectives: To develop a national lab-based surveillance system to monitor chlamydia in AI/ANs populations in IHS healthcare delivery system.

Methods: Laboratories providing chlamydia testing for IHS were contacted. Laboratories able to submit electronic reporting were invited to participate. File formats, transfer methods, data elements, and reporting periods were negotiated with each laboratory.

Results: 75% (6 of 8) laboratories participated. One laboratory declined because they were unable to report electronically. The other refused to provide the data. Data were collected from 54% (53 of 99) of all IHS health facilities through this electronic system using 6 different public and private laboratories. The data elements in these electronic files include positive and negative chlamydia test results, test date, site of specimen collection, DOB, age, age group, gender, provider, and facility.

Conclusions: A lab-based system removes barriers to surveillance for hard-to-reach groups such as the populations served by the IHS. Advantages of receiving electronic files directly from laboratories includes more timely reporting, a file format that is easier to analyze, and more data elements than in other STD surveillance systems.

A Comparison of Patient Characteristics and Provider Follow-up Methods of Untreated and Treated Chlamydia Patients at an Indian Health Service Hospital

L. Shelby, R. Pacheco, J. Cheek, D. Thoroughman, C. North

Background: Reasons why some STD patients never receive treatment is unknown in a primary care setting. Patients may not come back for follow-up care suggesting that hard-to-locate patients or ineffective provider follow-up methods may be significant barriers to patients receiving treatment.

Objective: To compare patient characteristics and provider follow-up methods of untreated and treated chlamydia patients at an Indian Health Service hospital.

Methods: A case control study was conducted on 68 untreated and 68 treated chlamydia patients. Patient and provider variables evaluated included gender, age, pregnancy status, patient locating information, reason for visit, specialty clinic, appointment type, provider workload, and provider follow-up attempts. Data collected were analyzed using the EPI INFO statistical program to determine relative odds of receiving treatment.

Results: Of 11,415 patients screened, 500 tested positive and 74 were never treated. Sixty-eight records were available for review. Sixty-eight treated patients were randomly selected as the control group. A provider not contacting patients by phone was a significant risk for not receiving treatment. Of the untreated group, 7 (10.3%) were phoned versus 24 (35.2%) of the treated group (OR=.21, 95% CI: .07, .57). None of the other factors achieved statistical significance. Of the untreated group, 34 (50%) had no documentation of provider follow-up. Twenty-one (30.9%) of the treated group also had no documentation but were treated at their next visit. Of the untreated group, 17 (25%) had subsequent visits but never received treatment.

Conclusions: Providers not contacting patients by phone was a significant risk for not receiving treatment. None of the other factors achieved statistical significance. Lack of documentation on medical records may have led to missed opportunities for treatment.

Learning Objectives: To highlight the importance of provider intervention to notify patients of their test results.

Sexually Transmitted Diseases: Gonorrhea, Chlamydia, and Syphilis Trends in American Indian and Alaska Native Populations from 1989 - 1998

S. Pirio, L. Shelby, J. Cheek

Background: In a previous study, gonorrhea and syphilis case rates were found to be twice as high in American Indian and Alaska Native (AI/AN) populations compared to non-AI/AN populations from 1984-1988.

Objective: To determine if this disparity persists, gonorrhea, chlamydia, and syphilis rates were examined in 14 states using surveillance data from 1989-1998.

Methods: Health Departments in Alaska, Arizona, California, Colorado, Minnesota, Montana, New Mexico, North Carolina, North Dakota, Oklahoma, Oregon, South Dakota, Utah, and Washington provided numbers of gonorrhea, chlamydia, and primary and

secondary syphilis cases. To determine crude rates per 100,000, general population data were obtained from 1990 U.S. Census and AI/AN population data were acquired from Indian Health Service. Average annual case rates were determined.

Results: While gonorrhea rates declined in both groups, AI/AN rates ranged 1.1 to 1.9 times higher than rates in non-AI/AN. Alaska had the highest gonorrhea rate which was 3.61 times higher for AN than non-AN (321.59/100,000 vs. 86.63/100,000). Chlamydia rates increased for both groups with AI/AN rates 2.0 to 3.7 times higher than rates in non-AI/AN. South Dakota had the highest AI chlamydia rate which was 7.5 times higher than non-AI (730.93/100,000 vs. 97.44/100,000). Although initially syphilis rates declined for both populations, rates began to increase in 1996 with AI/AN rates up 67.2% (11.99 to 36.54/100,000) and non-AI/AN up 12.4% (20.28 to 23.18/100,000).

Conclusions: Disparities in chlamydia and gonorrhea case rates between AI/ANs and Non-AI/ANs have persisted. Average syphilis rates have declined in both populations although rates in AI/ANs have increased more quickly than in non-AI/AN since 1996.

Learning Objectives:

1. Describe STD Trends in AI/AN populations over the last 10 years.
2. Understand that health disparities exist between AI/AN populations and non-AI/ANs in 14 states.

Assessment of Risk Factors for Repeated Chlamydia Infections.

Terence Mitchell, Greg Wood, Laura Shelby, Rachel Pacheco, Jim Cheek

Purpose: This study identifies risk factors associated with repeat Chlamydia infections among Native American females of reproductive age.

Methods: This is a retrospective case-control study. The subjects were reproductive age females (15-44 years of age) with at least one documented chlamydia infection from January 1994 through May 1998. Females with documented repeat chlamydia infections were cases (N=100), while the single documented chlamydia infection females were controls (N=237). A chart review was conducted to identify factors associated with the initial chlamydia infection that increased the risk for repeat chlamydia infections.

Results: Age <20 (OR 1.68, 95% CI (1.005, 2.82)), vaginal discharge as a presenting symptom (OR 2.36, 95% CI (1.29, 4.34)), and coinfection with gonorrhea at initial documented chlamydia infection (OR 4.47, 95% CI (1.40, 16.14)) were shown to have a significant effect on the risk for having a repeat chlamydia infection. Prior documented infection with bacterial vaginosis (OR 0.19, 95% CI (0.05, 0.533)) was significant as being protective from repeat chlamydia infections.

Conclusions: Increased prevention, counseling and other intervention efforts are needed for young sexually active females to prevent chlamydia infections. The sequela of not diagnosing and non-treatment are much greater and outweigh the alternative of increased morbidity and mortality from pelvic inflammatory disease, ectopic pregnancy, and infertility.

Completeness of HIV/AIDS Reporting among American Indians, New Mexico, 1980-2000

Richard F. Leman, J. Bertolli, J. Cheek

Background: Rates of HIV/AIDS among American Indians (AIs) are reportedly below those for the general population, yet rates of other sexually transmitted diseases (STDs), calculated from data in 14 western states, are higher among AIs: 58% higher for syphilis and 2.5 times the national average for chlamydia. These findings suggest reporting of HIV/AIDS among AIs may be incomplete.

Methods: We conducted an electronic search using all HIV/AIDS-associated International Classification of Disease, ninth revision-CM codes, searching databases for all Indian Health Service (IHS) and tribal health facilities located within IHS's Albuquerque Service Area (ASA), and in New Mexico, to identify all possible cases of HIV/AIDS diagnosed between 1980 and 2000. Identified patients were hand-matched by name and birth date with the HIV/AIDS surveillance database of New Mexico's Department of Health (NMDOH). We reviewed charts for IHS patients not found in NMDOH's database to determine if reporting should have occurred. Reasons for nonreporting were determined.

Results: Initial matching revealed 24/102 (23%) of AIs with HIV from the IHS search were not reported to NMDOH. Record reviews revealed that nine (38%) patients, negative for HIV, were miscoded as HIV positive, five (21%) were nonresidents, four (17%), were not reportable by criteria in use when last seen, and 2 (8%) were reportable. Four additional charts await review. Additionally, 46/124 (37%) of AIs from NMDOH's database and living within ASA were not found in IHS databases.

Conclusions: Although HIV/AIDS reporting for AIs was hypothesized to be incomplete, we found only two unreported cases from IHS facilities. Differences between HIV and STD rates among AIs in New Mexico cannot be explained by incomplete reporting.

Key words: Epidemiology, HIV-1, North American Indians

Outbreak of Community-acquired Methicillin-resistant *Staphylococcus aureus* (MRSA) Skin Infections among Yupik Eskimos in Southwestern Alaska, 2000

Henry Baggett, T. Hennessy, R. Leman, C. Hamlin, D. Bruden, A. Reasonover, P. Martinez, & J. Butler

Background: Recent reports of MRSA in patients without hospital exposure have raised concerns for a shift in MRSA epidemiology from health-care settings into communities. In August 2000, physicians in southwestern Alaska (population 20,000) reported an MRSA skin infection outbreak among patients without hospital exposure. We investigated the extent of community-acquired MRSA and the potential risk factors for disease.

Methods: We reviewed clinical and laboratory records of all patients with a positive culture for *S. aureus* at the regional hospital in southwestern Alaska from March 1999 through August 2000. Patients with a culture-confirmed *S. aureus* skin infection from one village were enrolled in a case-control study using age-frequency matched controls. We

also conducted a microbiologic assessment of saunas in the village and an MRSA nasal carriage survey.

Results: The percentage of outpatient visits due to skin infections increased from 1% to 3% from May 1999 through June 2000. The number of MRSA skin infections increased from 10 to 51 per month in this time period. From May 1 to August 10, 2000, 148 (85%) of the 175 *S. aureus* skin infections were caused by MRSA and 74% of these were community-acquired MRSA. Case-patients received more antibiotic courses than controls in the year prior to the outbreak (median 3.5 vs. 2.0 courses, $p=0.01$) and were more likely than controls to have an MRSA-colonized household member (OR=3.4, $p<0.01$). MRSA was cultured from 8 (17%) of 47 saunas; 44% of case-patients and 13% of controls used MRSA-positive saunas (OR=5.6, $p<0.01$).

Conclusions: In this large outbreak of MRSA skin infections in southwestern Alaska, three-fourths of the infections are community-acquired. Prior antibiotic use is associated with MRSA skin infections, and household contacts and sauna use likely play role in disease transmission.

Presented at 2000 Epidemic Intelligence Service Conference, Atlanta, GA.

Survey of Chlamydia Screening Practices for Males among IHS Health Care Providers.

Richard Leman, MD, EIS Officer

Background: Chlamydia screening in women at the time of annual pap smears is widespread in Indian Country. Extent of screening for males is unknown, but felt to be rare. Chlamydia rates among American Indians are 2.5 times the national average. Screening and treatment of males may be an effective weapon in controlling this epidemic.

Study Description: Cross sectional survey of all providers serving adolescent and adult males in a primary care setting at ten IHS facilities. Screening practices for male patients, provider attitudes toward screening in males, perceived barriers to screening, and institutional policies regarding such screening will be assessed.

Neonatal Septicemia in Indian Country: Trends in Neonatal Septicemia Hospitalizations among American Indians and Alaska Natives, 1980-1996.

Richard Leman, MD, EIS Officer

Background: Bacterial infections of the blood are an important cause of morbidity and mortality among neonates nationwide, but the extent of this problem is not well defined for American Indians and Alaska Natives.

Study Description: We will conduct a descriptive analysis of hospital discharge survey data. Data include all ICD-9 code-identified septicemia hospitalizations involving American Indians during the period of study, and were obtained through an electronic discharge

summary search of all IHS hospitals, of many tribal hospitals, and of inpatient facilities that contract with tribes or IHS to provide inpatient care for members of federally-recognized tribes. Facilities in the California and Portland Service IHS Areas were excluded because of insufficient data available. Comparisons will be drawn with data for the U.S. general population obtained using a similar method from the National Hospital Discharge Survey. **Status:** Literature review and initial analysis proceeding.

Comparative Evaluation of Health Status among Circumpolar Indigenous Groups

Richard Leman, MD, EIS Officer

Background: There are numerous, isolated examples of disparities between health status of circumpolar indigenous groups and the societies around them. A more complete, systematic evaluation will assemble the pertinent information for easy review, and perhaps provide a stepping-stone to effective public health intervention.

Study Description: A review of available data from regional, national and international sources is in progress. Once this information has been assembled, we will conduct a comparative, descriptive analysis, looking at both similarities and disparities in the health status of the various groups, as well as drawing comparisons between the indigenous groups and non-indigenous populations living in the same regions.

Contraception and Risk of Type II Diabetes among Native American Women

Richard Leman, MD, EIS Officer

Background: Exposure to progestins is thought to be a risk factor for subsequent development of type II diabetes in populations with a prior tendency toward insulin resistance. In a study of Latina women with prior gestational diabetes, risk for development of overt diabetes tripled if they had a subsequent pregnancy. A separate study of Latina women with GDM showed a three-fold increase in progression to overt diabetes among those who took a progestin-only oral contraceptive as opposed to refraining from hormonal contraceptive use.

Study Description: We will conduct a retrospective cohort study. A group of Native American women who have used combination oral contraceptives, a group who have used only non-hormonal contraceptives and a group who have used depo medroxyprogesterone acetate will be identified. We will include women who were between 20 and 35 years of age during the enrollment period (calendar years 1994 and 1995) and who had no history of diabetes at the time of enrollment. We will then determine the incidence rate of diabetes in each of the cohort groups, to see if choice of contraceptive is correlated with risk of developing diabetes.

Status: Protocol under development

Brainstem nicotine binding in autopsied American Indian infants of the Northern Plains

Leslie L. Randall, MPH, BSN, RN, Hannah C. Kinney, MD, Richard A Belliveau, AB, Laura S. Dominici, AB, Luciana A. Rava, EdM, BA, Lynn A. Sleeper, ScD, and Aberdeen Area Infant Mortality Study Steering Committee.

Background: American Indian infants have a high rate of sudden infant death syndrome (SIDS). SIDS has been shown to be linked to prenatal cigarette smoking. From 12/92 to 11/96, the Aberdeen Area Tribal Chairmen's Health Board, IHS, NIH/NICHD, and CDC conducted a case-control study of infant mortality. Elders and the Medicine Wheel Coalition of medicine men were consulted, and study protocols were conducted with their support.

Methods: Thirty-one cases (25 SIDS, 6 non-SIDS) from the Aberdeen study were compared with 39 non-American Indians (22 SIDS, 17 non-SIDS) from Children's Hospital, Boston MA. We used ³H-nicotine and tissue autoradiography for the examination of 14 brainstem nuclei related and unrelated to cardiorespiratory control and arousal.

Results: We hypothesized that there is an increase in brainstem nicotinic receptor binding in SIDS cases who were exposed to intrauterine cigarette smoke compared to SIDS cases not exposed and found no difference in Aberdeen or Boston cases. These results suggest that abnormal brainstem nicotine binding may not identify a SIDS subset exposed to intrauterine nicotine. The Aberdeen non-SIDS infants exposed to cigarette smoke pre- and/or postnatally have similar binding levels to those found in SIDS cases regardless of geographic origin and have lower binding levels than smoke-exposed non-SIDS cases from Boston.

Discussion: Because of lack of non-SIDS, non-smoking controls it may be virtually impossible to study the effects of nicotine exposure upon brainstem mechanisms involved in infant autonomic control and arousal in the Aberdeen Area because of the high prevalence of pre- and postnatal cigarette smoke exposure.

Presentation at the American Public Health Association Annual Meeting, 4014.0: Tuesday, November 14, 2000 - 8:59 AM. Contact [Nathaniel Cobb](#) for information.

Improving Cancer Incidence Estimates for American Indians in Minnesota

Melissa R. Partin, PhD, Stephen J. Rith-Najarian, MD, Jonathan S. Slater, PhD, Jane E. Korn, MD, MPH, [Nathaniel Cobb](#), MD, and John T. Soler, MPH

Objectives: The purpose of this study was to estimate cancer incidence for American Indians in Minnesota.

Methods: Indian Health Service enrollment data were linked to the Minnesota tumor registry to identify cancers among American Indians in Minnesota. Incidence rates for the 5 most common cancers in this population, estimated after the linkage, were compared with rates estimated before the linkage and with rates for the total of Minnesota.

Results: The lineage identified 302 cancer cases not previously identified as occurring among American Indians in Minnesota. Postlinkage estimates suggested that incidence rates for prostate and colorectal cancer are similar to those for the total population of Minnesota, but that rates of lung and cervical cancer are significantly higher. Breast cancer rates are slightly lower than those for the total population of Minnesota but more than twice as high as previous estimates for American Indians.

Conclusions: The postlinkage estimates suggest different priorities for cancer education, prevention, and control than might be assumed from either prelinkage estimates or previously published data, and underscore the importance of using accurate and specific data for setting these priorities.

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Lung Cancer Deaths and Smoking among American Indians

Nathaniel Cobb

Abstract

Lung cancer rates are mapped out along with smoking prevalence. The geographical differences are noted. All other cancers are grouped together and mapped along with the prevalence of smoking patterns and the comparisons are shown.

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Training for Cancer Control Research: A Curriculum for Native Researchers

Thomas M. Becker, MD, PhD, Jennie R. Joe, PhD, Nathaniel Cobb, MD, Linda Burhansstipanov, PhD, Catherine D. Pedersen

Background: Although the incidence of cancer among American Indians, Alaska Natives, Native Hawaiians, and American Samoans are high, few Native researchers have been trained to address these problems in their own populations.

Methods: The authors designed and implemented a cancer control research curriculum for 35 Native health care workers, and followed the progress of these trainees over a three-year period. The program included provision of technical support for trainees' grant and fellowship applications, graduate school theses, and other professional activities related to cancer control.

Results: Only a few of the trainees had professional positions related to cancer control at the beginning of the training sessions; however, a substantial proportion of the 35 trainees redirected their professional efforts toward cancer prevention and control. In addition, several of the training program graduates have been awarded fellowships and small grants for cancer control projects among Native groups.

Conclusions: The course may prove useful as a model for similar training courses among special population groups.

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Low National Breast and Cervical Cancer-Screening Rates in American Indian and Alaska Native Women With Diabetes

Jennifer Giroux, MD, Thomas K. Welty, MD, MPH, Floyd K. Oliver, PA, Judith S. Kaur, MD, Gary Leonardson, PhD, and Nathaniel Cobb, MD

Background: The cervical cancer mortality rate for American Indian and Alaska Native women is twice that of all races in the United States. To date the only published national breast and cervical cancer-screening rates for American Indian and Alaska Native women are based on self-reported data. When the Indian Health Service (IHS) conducts an annual audit on patients with diabetes, it includes cancer screening. This observational study presents national breast and cervical cancer-screening rates for American Indian and Alaska Native women with diabetes.

Methods: Cancer-screening rates were extracted from the 1995 diabetic audit for the 12 IHS areas. These rates were compared with rates from women without diabetes of the same age, 50 to 69 years, by chart review, at four IHS hospitals in the Aberdeen IHS area.

Results: Screening rates for women with diabetes in the 12 areas varied: mammogram (ever) 35% to 78%; clinical breast examination (last year) 28% to 70%, and Papanicolaou smear (last year) 25% to 69%. The Aberdeen IHS area women with diabetes had 51% more clinic visits per year than women without diabetes, but the groups had similar screening rates.

Conclusion: Cancer-screening rates for American Indian and Alaska Native women vary by region. In the Aberdeen IHS area, women with diabetes had more visits (missed opportunities) but similar screening rates as women without diabetes. The diabetic audit could be used to monitor national IHS cancer-screening trends from women with diabetes and in the Aberdeen IHS area for all women aged 50 to 69 years.

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Patterns of Cancer Mortality among Native Americans

Nathaniel Cobb, M.D. and Roberta E Paisano, MHSA

Background: Native Americans have been reported to have lower cancer incidence and mortality than other racial groups in the U.S., although some have questioned whether this was due to racial misclassification. This study provides improved estimates of cancer mortality, determined from a sampling of people who live on Indian reservations.

Methods: The authors reviewed death certificates from U.S. counties that contain Indian lands, excluding certain areas with known problems of racial misclassification. Age-

adjusted mortality rates for specific types of cancer were calculated using U.S. Census population figures, and these rates were compared with rates for all races in the U.S.

Results: This sample included 38% of the American Indian and Alaska Native populations. The age-adjusted annual mortality rate for all cancers combined was 148.2 per 100,000 for both genders, 133.1 for females, and 167.2 for males. The rates for males and for both genders combined, but not for females, were significantly lower than the U.S. rates for all races ($p < 0.05$). Females had significantly lower rates of death from carcinoma of the lung and breast and significantly higher rates of death from carcinoma of the cervix and gallbladder ($p < 0.05$). Males had significantly lower rates of death from carcinoma of the lung, colon, and prostate, and significantly higher rates of liver carcinoma. Both genders combined had significantly lower rates of death from stomach, liver, kidney, and gallbladder carcinoma. Geographic differences were substantial, with the Northern and Plains regions experiencing much higher mortality from lung, colon, and breast carcinoma than the Southwest region.

Conclusions: Compared with the general U.S. population, Native Americans experience quite different patterns of cancer mortality. Cancer prevention and control programs should be designed specifically for this minority population.

Published: Cancer 1998;83:2377-2383.

Stage at Cervical Cancer Diagnosis Among American Indian Women: Is distance to primary care more important than age?

Robin Taylor, Ph.D., Christopher Pouliot, MS, Nathaniel Cobb, MD, Charles Key, MD, Ph.D.

Background: Cervical cancer is still among the three leading cause of cancer death among American Indian (AI) women.

Hypothesis: Greater distance to primary care is associated with late stage cervical cancer.

Methods: Staged first primary AI cervical cancer cases diagnosed in 1994-1997 were identified through the New Mexico Tumor Registry (n=212). Late stage was defined as AJCC stages I-IV. Case information was linked to Indian Health Service (IHS) inpatient and outpatient utilization records. Road distance to the nearest IHS/tribally-run hospital or health center was determined using ArcView's Network Analyst (ESRI, Inc.). Logistic regression was used to test for associations with late stage outcome.

Results: Compared with ages 17-34, women in each successive 15-year age group experienced an increased and statistically significant doubling in the risk of late stage cervical cancer. Compared with those nearest a facility, women residing >0-8.7 miles were 2.5-times more likely to have been diagnosed with late stage cervical cancer (OR=2.5; 95% CI: 1.1-4.8, trend $p=0.2$). In multivariate logistic regression models, distance was not statistically significant, while age, urban residence, healthcare utilization, type of health care facility, and comorbidity remained significant. Late stage cervical cancer was 25 times more likely among women 65+, compared with women 17-34 (multivariate OR=25.0; 95% CI: 7.1-100.0).

Conclusion: Unlike non-Hispanic Whites, over half (55%) of AI cervical cancer cases age aged 35+. Within the context of continuing AI cervical cancer mortality, the significance of age, in spite of other measures of access to care, suggests the need for age-targeted screening efforts.

The Role of Primary Care Patterns in Stage at Diagnosis Outcomes among American Indian Cancer Patients in New Mexico and Arizona

Robin Wilson, Ph.D.

Background: Compared with other racial/ethnic groups, American Indian (AI) populations in New Mexico and Arizona are most frequently diagnosed with late stage cancer. Indian Health Service (IHS) and tribally-run facilities provide the majority of primary care services for AI in the region at 19 hospitals and nearly 50 ambulatory clinics. It is not known whether late stage at diagnosis may be attributed to geographic limitations in primary care locations, or to a reduced utilization of preventive clinical services.

Methods: Arizona and New Mexico AI colon, breast, cervix and prostate cancer cases diagnosed in 1994-97 were identified through the SEER New Mexico Tumor Registry (NMTR) and linked to IHS registration records. The following cases were excluded: autopsy, death certificate and convalescent home only reporting source; cases not registered with IHS; cases with a second or greater primary; and those with non-epithelial, carcinoid (colon), transitional cell (prostate), inflammatory (breast) and paget's disease (breast) histology. AJCC (5th edition, 1996) stage at diagnosis outcome was determined using SEER extent of disease codes. Based on the US all-races 5-year relative survival under 80% and anatomic extent of disease, early and late stage outcome was defined as AJCC stages 0/I/II and stages III/IV, respectively, for colon, breast, prostate and all 4 sites combined. AJCC stage 0 cervical cancer was defined as early stage, and AJCC stage I, II, III, and IV cervical cancer were defined as late. Latitude and longitude for community of residence, and zip code of residence in urban areas were determined using the Geographic Names Information Database, administered by the US Geologic Service. The street address mapping function in ArcView (Streets USA extension), version 3.2a (ESRI, Inc.), was used to determine facility location. Using the 1995 Tiger streets files (Intergraph, Inc.), the driving distance to the nearest facility was calculated using the Network Analyst function in ArcView. Urban residence and urban facility were defined as located in Albuquerque, Mesa, Phoenix, Santa Fe, Scottsdale, Tempe, or Tucson. IHS and tribal inpatient and outpatient electronic records were used to determine the frequency of comorbid conditions, inpatient stays, outpatient visits, and the number of MD/DO clinicians seen in an outpatient setting during the 14 months prior to diagnosis, but excluding the 30 days prior to diagnosis. Comorbidity was defined using categories investigated by Charlson (1987) and Elixhauser (1999) through ICD-9-CM and IHS Ambulatory Patient Care codes (APC) in IHS inpatient and outpatient utilization records. The percent of families living in poverty by zip code, according to the 1990 US Census, was used as a proxy measure of economic status. Chi-squared and Fisher's Exact Tests were used to test the significance of each variable on stage outcome. Among all sites combined, the Breslow-Day test of Homogeneity was used to test for the interaction between age and the following: any comorbidity, diabetes, urban residence, utilization

frequency, and distance. Logistic regression was used to control for the effects of age while determining other significant associations (p-value <0.05). The Adjusted Odds Ratio (AOR), calculated by logistic regression, included age and other statistically significant variables. Variables with Pearson's correlation coefficients of 0.50 and larger were placed in separate models. Significant lack of fit for logistic regression models was calculated using the Hosmer-Lemeshow Goodness-of-fit test (p-value ≤ 0.15).

Results: NMTR identified 753 colon, breast, cervix and prostate cancers among 742 AI persons, of which 97.7% (725/742) were matched to IHS registration records. After applying exclusion criteria, there were 124 colon, 184 breast, 213 cervix and 129 prostate cases that could be assigned an AJCC stage for analysis (650 total). Adjusting for age at diagnosis, comorbidity and utilization frequency, distance to the nearest IHS/tribal facility was significantly associated with stage among colon and prostate cancer cases. Among colon cancer cases, persons living >10 to 25 miles of a facility were significantly more likely to be diagnosed at an early stage, compared with those living closer to the facility (AOR=4.0; 95% CI: 1.48-11.09). Among prostate cancer cases, persons living at the distance quartile of 8.7 to 25.6 miles were over 4 times more likely to be diagnosed at an early stage, compared to persons closer to the facility (AOR=4.4; 95% CI: 1.20-15.78). There was insufficient statistical power to detect stage differences at greater distance. For cervical cancer, there was not a consistent association with distance measures and stage. In contrast to the findings for colorectal and prostate cancer, greater quartile driving distance was associated with a lower likelihood of early stage cervical cancer diagnosis, however this was not significant after age-adjustment. In general, a significantly higher proportion of elderly cases resided at greater distance from primary care. Among cases residing within 10 miles, 32.0% were age 65 or older, compared with 46.4% of those within 25 to 50 miles ($p=0.002$, four sites combined). Breslow-Day tests for age as an effect modifier were non-significant. Plots of mean stage by distance quartile suggested a 'U'-shaped function among colorectal, breast and prostate cancer cases—with higher stages at distances closest to the facility, which first decreased and then increased again as driving distance increased. Urban residence and type of nearest facility did not explain the distance association among prostate and colon cases, however, early stage at cervical cancer diagnosis was 5 times less likely among urban residents (AOR=0.2; 95% CI: 0.05-0.67). Urban facility location was not significantly associated with cancer stage. Early cervical cancer stage was also significantly associated with younger age, type of nearest facility (hospital), an inpatient stay, and gallbladder disease. Likelihood of early stage cervical diagnosis was significantly lower at older ages. Women aged 35 to 49, 50 to 64 and 65 and older were respectively five-, ten- and twenty-five-times less likely to be diagnosed with early stage cervical cancer, compared with women aged 17-34 (65 and older: AOR=0.04; 95% CI: 0.01-0.13). Women who resided closest to a health center were approximately 3.3 times less likely to have been diagnosed with early stage cervical cancer, compared with women residing nearest a hospital (AOR=0.3; 95% CI: 0.13-0.67). Comorbidity and inpatient stay were generally associated with an improved stage for those diagnosed with colon (diabetes), breast (hypertension), cervix (gallbladder), and prostate (any comorbidity) cancer. However, among breast cancer cases, chronic renal disease (AOR=0.04; 95% CI <0.01-0.40) and ischemic heart disease (AOR=0.03; 95% CI: <0.01-0.46) were associated with a considerable decrease in the likelihood of early stage diagnosis. Greater outpatient utilization frequency was significantly associated with early stage breast, cervix and prostate cancer (all tests for trend $p<0.05$). The effects of utilization frequency were most pronounced among prostate cancer cases at the highest

utilization quartile (10 or more visits vs. no visits: AOR=8.3; 95% CI: 1.83-37.65). Finally, AI women with colon cancer were approximately one third as likely to be diagnosed at an early stage, compared with men (AOR=0.3; 95% CI: 0.15-0.77), and this relation persisted after adjusting for comorbidity (i.e., diabetes) and driving distance.

Discussion: Age, sex, driving distance to primary care, type of nearest facility, urban residence, comorbidity and primary care utilization were significantly associated with cancer stage, dependent upon on cancer site. Within a 25-mile limit, these results suggest an inverse relationship between driving distance and stage at diagnosis among AI colorectal, breast and prostate cancer patients. Persons residing farther from a facility may more likely receive transportation services from community health representatives who may encourage cancer screening. Additionally, persons living in communities farther from facilities may have greater access to social networks, which promote health-seeking behavior or that may be more easily reached with cancer prevention messages. Similarly, the greater likelihood of early stage cervical cancer among non-urban AI women may be due to greater difficulty in targeting cancer-prevention messages to urban AI populations. Older age may be a better predictor of late stage cervical cancer than distance to primary care. However, the fact that the highest proportions of AI women and men 65 and older live at greater distances (between 25 and 50 miles of a facility), suggests that distance will still be a barrier in increasing cancer screening among elders. Most CDC-funded cervical cancer screening programs among AI in this region are hospital-based, which may explain why persons residing closest to a hospital were more likely to be diagnosed with early stage cervical cancer. These results imply that expanding programs to health centers could improve cervical cancer stage distribution for women served at these facilities by 3-fold. Some comorbid conditions may increase the frequency of contact with the clinical system and lead to earlier detection of cancer, while others may inhibit early cancer detection. Based on the reduced likelihood of early stage breast cancer among AI women with ischemic heart disease or chronic renal disease, investigation into the severity of comorbidity as an impediment to early breast cancer detection among AI women is warranted. In this cohort, half of those women with breast cancer and ischemic heart disease or chronic renal failure, died from breast cancer within 13 months of diagnosis. These results suggest that immediate intervention steps to improve stage at diagnosis outcomes are increased cervical cancer screening among AI women aged 35 and older, improved cervical cancer screening rates at health centers, and increased awareness of colon cancer among AI women and healthcare providers.

Doctoral dissertation. Contact [Nathaniel Cobb, MD](#) or more information.